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Notes on the flora of the Lake Superior region. II.

E. J. HILL.

The early part of my time at the north was favorable for work among the Carices, as they continued to be in a good condition for study there till the middle of August. There are some which we expect to find as restricted to the northern regions, or, if more widely spread, are more common there. Among those found in the neighborhood of Champion may be mentioned *C. tenuiflora* Wahl., in low places in cold woods; *C. trisperma* Dewey, abundant, and usually in company with the equally abundant *C. polytrichoides* Muhl., everywhere in springy ground and along the rills; *C. Deweyana* Schwein., in dry ground among bushes, but not abundant; *C. Magellanica* Lam., in bunches in peat bogs, generally in the shade of tamaracks, and, though slender, striking on account of its purple scales; *C. arctata* Boott, quite like its more widely spread congener, *C. debilis* Michx., var. *Rudgei* Bailey, but with stiffer stem and much broader and shorter leaves, both growing in tufts in rather cold woods; *C. varia* Muhl., in dry woods. Of these the last two and C. polytrichoides are also found at the head of Lake Michigan. *C. monile* Tuckerm. is seen everywhere in the watery ground, its roots usually submerged and often provided with very long stolons. It is exceedingly variable in some of its characteristics, and puzzling to make out. The variations affect size of spike, width of leaves, and size in general, and sometimes the fruit. The spikes are sometimes long and rather thick, or they may be short, or narrow and interrupted, or very loosely flowered, much as in var. *monstrosa* Bailey. One of the most puzzling was found in a swamp at Humboldt, having a short and thick perigynium and the beak almost entire, but evidently C. monile. In the same swamp was found *C. oligosperma* Michx. It has a tall, stiff, few-leaved stem, the spikes small and aggregated near the top, reminding one of a Scirpus or Eriophorum. By the wet margin of Michigamme lake some abnormal specimens of *C. retrorsa* Schwein. were seen, with a single sterile spike and small fertile ones, bearing some resemblance to *C. lurida* Wahl. *C. flava* L. seems at the north to take the place of *C.*

flava var. *viridula* Bailey, that is common further south, and very abundant in wet sands near Chicago. Collections at the foot of Lake Michigan at Petoskey and Escanaba are of the type, those about Chicago of the variety. Nor is it reported from this vicinity by others. Some from Calumet were of a mixed character, though referable to the type. They sustained the reduction of the former C. Œderi to a variety, for otherwise it would not have been easy to place these with satisfaction.

Of other sedges notice may be taken of *Scirpus polyphyllus* Vahl., which we do not find here. It is quite far north for the species, and may be looked upon as rare. It was found at Champion. *Eriophorum cyperinum* L. of the typical form, its spikes clustered in heads, grew in the same locality. I do not find it so often as the forms with drooping rays, which are the common ones.

Some of the grasses gathered in the neighborhood of Champion deserve mention. *Poa debilis* Torr. grew in tufts in dry open woods, its stems very slender as the name indicates, but the flowers acute rather than obtuse as they are described to be. *Danthonia spicata* Beauv. was common in the sterile soil along the "Granite Range;" and in wettish ground a diminished form of Bromus ciliatus, but fifteen inches to two feet high. *Cinna pendula* Trin. was seen in the borders of damp woods; and in the damp upland woods *Millium effusum* L. Specimens of Avena were found in the cold woods that do not accord well with either of the two species of our northern borders, a smooth slender plant from a foot and a half to nearly three feet high, the radical leaves from 6–12 inches long and but a line or two wide. The glumes have more nerves than those of A. striata or A. Smithii, varying from three in the outer to thirteen in the flowering.

Ten days of my time were spent at Marquette. This is the port from which most of the iron of the region is shipped, for which it affords excellent facilities in its long docks down to which the cars descend from the surrounding hills. It is the finest town in the Northern Peninsula, and a pleasant place in which to pass the summer months. Bold, rocky hills are close by on the south and east, the ledges of which come close to the shore of the lake, and from whose tops may be obtained extensive views of the surrounding country, the low Huron mountains being in sight to the north and west. Here the rocks of the Iron Group and of the Lauren-

tian are skirted along the shore by the sandstones of Lake Superior, and there are sandy reaches with a corresponding modification of the flora of the lakes with much the same facies as seen in analogous cases by Lake Michigan, except its more northerly coast. Close to the city on the north is a tract of Red Pine. The groves of this pine, with their park-like appearance, are always attractive, though too clean to furnish much variety to the collector of plants. All is open beneath the straight, trim trunks, and there is a stillness almost to loneliness except for the sighing of the winds among the leaves, which tends to intensify the feeling. Without bushes to obstruct the view, or impede progress, one can ride or drive almost anywhere except for a fallen tree here and there. The ground is matted with a floor of dry needles, elastic, clean, and free from dampness, and one can sit or lie down without danger of cold. But the variety that is lacking in the grove may be found in the lower or swampy ground between it and the shore, where ridges of sand alternate with reedy or grassy sloughs, then come the beach and its outlying rocks. Here is a sand barren such as are seen in many places by the shores of the great lakes. Through this runs a good road for two or three miles, going north by the shore to Presque Isle, a part of the city as well as the road, and used for a park and pleasure drive. Few cities can offer a finer one for beauty of situation, or for the views of the lake that may be obtained from it. Presque Isle is a promontory jutting out into the lake, rising to the height of one hundred and fifty feet, and ending precipitously in cliffs of sandstone and eruptive or conglomerate rock. The upward slope is gentle, and the road makes the circuit of it, near the shore where the sandstone predominates, but forced back on the northeast side by ravines and ridges. It is thickly overgrown with timber in its native wildness, hard woods interspersed with pines and hemlock. The point is properly named, for it is nearly surrounded by the waters of Lake Superior and by swamps bordering the lake and Dead river, crossed just before reaching it. Narrow ridges of sand, but little above the level of the swamps, connect its base with the hills to the westward. It is a favorite place to which citizens and visitors resort for driving and for pleasure, but I chose to make my trips on foot, as detours were possible along the road by foot-paths leading into the adjoining woods. Many of the plants were of kinds previously seen, but there were enough strange ones to give zest to the work.

Three of the Fumitory family grew on Presque Isle, Corydalis glauca, C. aurea and Adlumia cirrhosa. C. glauca was common on the rocks at Champion, and C. aurea had been gathered near Carp river, south of Marquette, but all flourished here side by side. Corydalis takes to gravelly soil as well as rocks, not so often with C. glauca as with C. aurea, as it is unusual for the former to be found away from the nearly bare rocks, where they grow in a thin covering of soil. And it was damp enough for the Adlumia, which grew in plenty on the steep banks of the shore, as well as in the edges of the woods with the others. All being in bloom and of vigorous growth, the smooth glaucous plants covered with purple and yellow flowers, afforded a handsome sight. There was the same peculiarity in the flowers of C. aurea as in those found at Quinnesee in 1883, the prominent crest denticulate and the other petals dentate-ciliate. This is not mentioned in our books, for it is regarded as a mark of a group including C. flavula and its allies. Adlumia cirrhosa seemed somewhat out of place so far north, and may have been introduced, though there were no evidences of it from the surroundings. The plants were very vigorous, the stems several feet long, especially on a slope where the timber had been burnt and the ground scorched by the fire, a kind of soil in which the plant appears to delight. But the latitude may not be against its nativity here, since it is reported by Macoun at Rivière du Loup, on the lower St. Lawrence, a latitude more northerly than Marquette. He mentions other stations nearly as far north, one of them Gore Bay, on the north side of Grand Manitoulin Island, Georgian Bay.

The rocks on the extreme north-east part of Presque Isle are eruptive in character, a dark, almost black magnesian serpentine, weathering with a very rough surface. They spread out flat and nearly bare over a space of several acres, and in places where they join the conglomerate are pervaded by a network of sparry veins filled with various minerals of a lighter color, which gives them a unique appearance when seen dipping under the clear water of the lake here entirely devoid of sand. Being worn smooth by the waters they show a tesselated structure, and the lighter colored lines dividing the blocks often seem to undulate and gyrate in the sunlight simulating the motion of the wavelets.

In the cup-like cavities of the surface of these rough rocks, where some earth had lodged or a soil been formed, a few plants were seen, mostly grasses and Solidagos. The

usual Solidago was *S. juncea* Ait., common in the cavities and crevices of all the cliffs by the shores about Marquette. They are from one to two feet high, and generally have very narrow leaves, all entire or nearly so. But the most interesting growth in these tiny hollows, sometimes but an inch in diameter and completely filled with the roots of the plants, were the tufts of a small grass, six to eight inches high, *Trisetum subspicatum* Beauv., var. *molle* Gray. It was not abundant, but in a good condition for collecting the last of July.

Three other small plants, which I had not seen before, were found on these rocks. They grew together in a larger hollow filled with water evidently from the rains or from the spray of the waves when they ran high. Nourished by this little pool, by the borders of which some soil had gathered, or clinging to the damp rock, they occupied but a foot or two of space. Rooted in the soil were Scirpus cæspitosus and Primula Mistassinica, and, on the face of the rock by the edge of the water, Pinguicula vulgaris. It was too late in the season for the flowers of the last two, and I had to be contented with the plants in fruit. None of these are common plants, though widely spread throughout our northern borders and beyond, the Scirpus extending further south and with a wider range. It is a mountain or sub-alpine plant, mainly found on the mountains in the eastern states, but coming more into the swamps in the region of the lakes. It is represented in the flora of Roan Mountain, N. C., and at the west in the Rockies. The plants are very slender, and the fruit in those found was mostly aborted.

The two native Primulas of our flora are also northern plants, keeping well to the basin of the St. Lawrence and northward when away from the coast region. P. farinosa I have seen but once, at Petoskey, where it grows in sandy soil. Both are plants of wide distribution, being found in Europe. P. farinosa is also found in Asia, and in Antarctic America by the Straits of Magellan and on the Falkland Islands—the *P. Magellanica* of Lehman, but joined to *P. farinosa* by De Candolle. At the north it goes around the world, and is one of the few terrestrial plants represented in the cold regions of the northern and southern hemispheres without any known intertropical stations. Both plants are very small, and it is generally the small plants that make these wide migrations. The Scirpus is likewise a plant of Europe, and the Pinguicula of Europe and northern Asia. This

seems to have been collected by Dr. Douglas Houghton on Presque Isle, when he accompanied Schoolcraft to the source of the Mississippi in 1832, since he mentions it in the list of plants appended to the narrative of the expedition. But he seems to have been in doubt as to its specific character, the notice of the plant reading, "Pinguicula (n. spec.) Presque Isle, Lake Superior." My specimens seem in no way peculiar, the only characteristic not anywhere mentioned being the deeply violet or almost purple tinge of many of the leaves. Hence I take this to be the plant, since the two other northern species of Pinguicula, P. alpina and P. villosa are not known to occur in our district. In an explanatory note prefixed to the list he intimates that a more detailed account of the plants would be published at some future day, but I am not aware that this was ever done.

Some plants of interest were found by the beach. The Evening Primrose was the common Œnothera biennis, but it approaches *Œ. Oakesiana* Robbins. Its flowers are smallish, leaves narrowly lanceolate, the pubescence mostly short and soft, the stem becoming nearly or quite smooth at the base. The same was observed along the shore on Keweenaw Peninsula. *Ammophila arundinacea* Host. grew in plenty in a ridge of sand between Dead river and Presque Isle. It was a narrow ridge between the carriage road and lake, and the utility of the plant was well shown by its power to hold the loose sands in place against both wind and waves. For this purpose it has been planted on the Atlantic coast, as at Provincetown, Mass., whose harbor, as well as the town, are said to owe their preservation to this plant. A special law in England and Scotland protects it from destruction for a like purpose[1]. It goes vertically down for some distance into the sand, and is copiously furnished with running rootstocks, which, with the broom-like habit of growth of its stiff culm and leaves, well adapt it to catch and hold the shifting sands. It is found by the shores of Lake Michigan, as at Whiting, Ind., but is not as common as Calamagrostis longifolia, that serves a similar purpose. Another grass of the beach was *Agropyrum repens* Beauv., appearing harmless enough here as compared with the grass so troublesome to the farmer under the name of Couch, or Quick-grass. Although the sands are light and offer no impediments to its spreading, it does not generally possess the long and running stolons that characterize it in the cultivated fields, and make it so difficult to

[1] Abbe Provancher, Flore Canadienne, p. 681. Vasey, Agric. Grasses, p. 70.

contend with. This may be due to the poorer soil, and a plant harmless in its native place becomes a noxious weed when supplied with abundant food in the farm and garden. From the conditions of growth, accompanied by Panicum virgatum and the willows and cornel bushes characteristic of the shore, and cut off by a wide extent of swampy land and woods from any cultivated fields where it might be growing, I consider it indigenous here. It was found once before under analogous conditions of growth upon sand hills in the woods and barrens east of Petoskey, and at a distance from farms, and the conclusion was plain that it was a native grass. It was accompanied by *A. dasystachyum* Vasey, regarded as indigenous along the great lakes. The evidence of nativity in both is equally good, and the conditions of growth can not be disconnected so as to give a different origin to the two. The plants found at Marquette were mostly taller than those in cultivated ground, and grew somewhat isolated, generally not more than a single stalk from the same root.

Another native grass, Festuca ovina, was collected in this vicinity. It was found on a mass of rock, called Picnic Island, much frequented by the children of the city for their pastimes. It is an island only when the waves are high, being joined to the mainland by a low sand-spit ending in this rock, and accessible on foot at ordinary times. Several kinds of plants grew here, where the crevices and cavities protected them from the tramplings of the busy feet, among them the most interesting being the Festuca and the Trisetum mentioned above. It is a low plant from six to twelve inches high, and is known to be native about Lake Superior and other parts of the north, and naturalized in pastures further south. I have seen it but once in the vicinity of Chicago, on the banks of the Calumet, in the woods about a mile east of Hammond, Ind. It may be a native here, since several other northern plants are present at the head of Lake Michigan, and I do not know that it grows elsewhere in our fields, either from my own or the observations of others. It is confined to a small area in the edge of the woods.

On another spur of rock, Light-house Point, jutting out into the lake, and forming the harbor of Marquette on the north, grew the Dwarf Service-berry, *Amelanchier alnifolia* Nutt. It was a small shrub but a foot or two high, and presented a handsome appearance with its abundance of purple fruit, as it clung to the rocks, rooting in the crevices or where it could find a foothold. It might be utilized as a plant for rock-work.

In the swamp to the north of the city, *Juncus stygius* L. was seen in a few places. It is a very slender rush, and rather rare, occurring sparingly on our northern borders and the neighboring parts of Canada.

A form of Solidago humilis, from 12–18 inches high, was collected in the sandy land near the mouth of Carp River. The floral portion of the stem is quite pubescent, and the part below slightly so, but the plant is smooth at the base. The leaves are sharply serrate, or somewhat toothed, approaching the variety Gilmani, but hardly marked enough to be separated from the type.

Among vascular cryptogams, or pteridophytes, one sees in plenty the five common species of club moss, and once in the wet sands north of Marquette the rarer Lycopodium inundatum was detected. It is also found in our own vicinity at Tolleston and Millers, growing in similar places, though I have not seen it elsewhere in collecting about the lakes, although it has a few other stations assigned it. East of Marquette on the ridges of the rocky wooded hills sloping toward the lake, grew in abundance Equisetum scirpoides, the smallest of the horsetails, and not very common, though it ranges throughout the region of the lakes. I have met with it but once before, at Northport, Grand Traverse Bay, where it sometimes took as a habitat stumps and logs on which sand had lodged. A noticeably small form of Botrychium Virginicum, from 7–9 inches high, was found beside Teal Lake, Negaunee, and in the Keweenaw Peninsula, like that described as *B. gracile* Pursh. Wherever seen the species seemed more slender than the common form farther south.

Englewood, Ill.

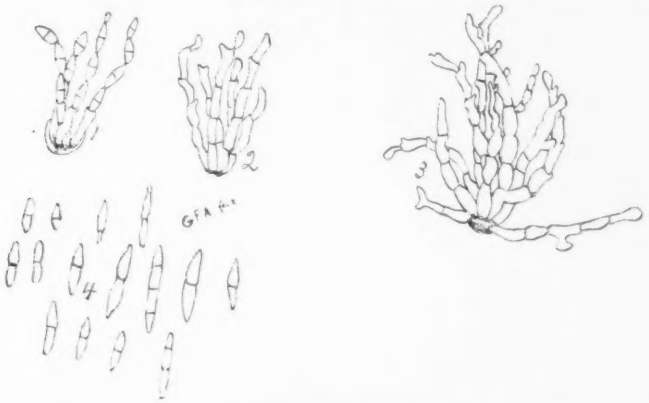
A new Ramularia on cotton.

GEO. F. ATKINSON.

During the autumn of 1889 I collected from several different plantations in the vicinity of Auburn, Alabama, leaves of cotton infested by a fungus which proves to be an undescribed species of Ramularia. In view of the importance of cotton culture and the fact that some species of Ramularia are known to be quite destructive to a few cultivated plants it may not be out of place to record the discovery and characterize the fungus.

Although the spots are not very distinct on the upper side of the leaf, except in cases where the hyphæ are epiphyllous, or the spots are quite old, the presence of the fungus is easily detected in passing along by the plants, for the leaf is quite translucent in the diseased places, so that the irregular angular areas present a very light yellowish green color in distinction from the darker green of the healthy portions of the leaf.

In this respect it reminds one of such species as *Ramularia serotina* E. & E. (N. A. F. 2463), and *R. virgaureæ* Thüm. (N. A. F. 2291), as well as one can judge from those in the dried state, though the spots on the cotton leaf are not so plainly visible above when the leaf is dry. The spots of R. areola are also larger and more definitely angular. The



conidia and hyphæ differ from those of R. serotina in being proportionately stouter; from R. virgaureæ, which, by the way, Ellis and Everhart say pertains to Cercospora,[1] also in being stouter and the conidia not so long as they some times are in that species.

The conidia are developed in great profusion and in an undisturbed condition give to the under side of the leaf, to the unaided eye, the appearance which certain species of the downy mildews give to their hosts, and before an examination with the lens I anticipated a Peronospora.

In the early development of the conidia the hyphæ are quite uniformly short and the conidia concatenate. As the

[1] Journal of Mycology, Vol. V., no. 2, p. 69.

fungus ages the hyphæ are longer and fewer conidia remain in chains. When the conidia are not so profuse as to cover the surface of the spots, with the aid of a lens the hyphæ can be seen in definite clusters. As the hyphæ age it is not infrequent for the conidia to be unilateral when the hypha will be curved as some are represented in fig. 4.

The figures will be easily understood, the progress of development of the hyphæ being shown from figs. 1 to 3.

Ramularia areola n. sp. Spots hypophyllous, rarely amphigenous, pale at first, becoming darker, 1–10 mm. (mostly 3–4 mm.), angular, irregular in shape, limited by the veins of the leaf, conidia in profusion giving a frosted appearance to the spots. Hyphæ hypophyllous, rarely amphigenous, fasciculate, in small clusters distributed over the spots, subnodose, older ones frequently branched below, more rarely above where they are toothed, teeth frequently unilateral when the hyphæ are curved instead of zigzag, several times septate, stouter below, hyaline, 25–75μ×4.5–7μ. Conidia oblong, usually abruptly pointed at the ends, sometimes rounded, 1 to 3-septate, concatenate in the early development of the hyphæ, hyaline, 14–30μ×4–5μ.—On leaves of Gossypium herbaceum, Auburn, Alabama, Oct.–Nov. 1889. Geo. F. Atkinson.

Auburn, Ala.

Notes on technique. I.

JAMES ELLIS HUMPHREY.

Although the value and importance of good permanent mounts for the microscopic study of algæ and fungi is generally recognized, most of the methods by which they are prepared are tedious in detail or unsatisfactory in results, or both.

The balsam slide is to be regarded as the one embodying the desirable features of such a preparation ; namely, transparency, simplicity in manipulation and indefinite preservation of the specimen in a solid medium which will neither run nor leak. Balsam, however, is unsuitable as a medium for most of the thallophytes, and we are compelled to seek a substitute which is less dense and which mixes readily with water. The best results have hitherto been obtained with the algæ by the use of solutions

of preservative substances in water, and with the fungi by the use of glycerine, usually diluted with some antiseptic fluid or solution of low density. But all such media are permanently fluid and require the use of artificial cells to contain them. These cells when not built wholly of some cement depend on such a material for their security, and require to be made with the greatest care and to be freshly coated at intervals. After a considerable experience with nearly all the best cements, I am convinced that none is wholly to be relied on, while the trouble of manipulating them and of preparing satisfactory mounts in fluid makes the abandonment of the whole technique extremely desirable. Further, very few of the liquids in use preserve delicate histological features or differential staining.

About the only available non-resinous solid medium is *glycerine jelly* which has proved so entirely applicable and so well adapted to the preservation of algæ and fungi that fluid media and cements, which have been used chiefly for these plants, may be now relegated to the limbo of superseded evils.

The object of the present note is to call the attention of American botanists to a mode of treatment preliminary to mounting in glycerine jelly, which is not complicated in detail, is very satisfactory in its results, and is widely applicable among the thallophytes. In *Hedwigia* for 1888, Heft 5 and 6, page 121, Dr. L. Klein described his method of preparing slides of fresh-water algæ, which the writer has found very successful and convenient.

The prime secret of success in the use of glycerine jelly is to have the object thoroughly permeated by glycerine before it is placed in the medium. But the well-known dehydrating action of glycerine causes a rapid and irreparable shrinking and collapse of delicate watery tissues placed in it, even though it be very much diluted. Several reagents extensively used by histologists have the effect of hardening or coagulating tissues, so that they become much less easily distorted by subsequent manipulation. Of these reagents there is one which acts very quickly and produces hardly any perceptible change in the living appearance of the tissue or organism, simply fixing and preserving the details of its structure. This is the substance known as *osmic* or *perosmic acid*. It is used in aqueous solution of a strength not exceeding one per cent. of the acid. Experience has shown that

this reagent is especially adapted to fixing and hardening the more delicate algæ without structural change. The plants to be treated are placed in a drop of water on a slide, and, if they are comparatively large, a drop of the one per cent. solution of osmic acid is added and the whole is allowed to stand for perhaps half an hour. The fluid must, however, be drained away from the plants before they begin to show the browning or blackening which results from the prolonged action of the acid. In the case of very small or unicellular plants, it is sufficient to invert the drop of water containing them over the mouth of the reagent bottle, since the fumes of the acid will produce the desired effect in a short time.

Even after being thus hardened, algæ can not safely be treated with glycerine of greater strength than that resulting from a mixture of one part with eight or ten parts of water. They should be allowed to stand, protected from dust, in a small quanity of this mixture, which gradually decreases in volume and increases in density until it nearly reaches that of pure glycerine, by the spontaneous evaporation of its water. The concentration is so slow that not the slightest shrinking ordinarily occurs in plants first fixed with osmic acid. A couple of days is usually required for its accomplishment.

After draining away the excess of glycerine, one may add a drop of glycerine jelly, warmed just sufficiently to render it fluid, and then cover at once. Air bubbles are more easily avoided if both slide and cover glass are gently warmed. Slides carefully prepared by this method preserve details of structure and the natural appearance of the plants with striking completeness and show no change after a considerable time, as the writer can testify.

Besides applying this process to the preservation of freshwater algæ, for which it was especially recommended by Dr. Klein, I have had opportunity to test its applicability to other thallophytes. At the marine biological laboratory at Wood's Holl, Mass., in August last, it was used by the students in botany in preparing all their slides of marine algæ, and with much success. Members of all the chief groups were mounted with excellent results. Some of my most careful students report that all, or most of their preparations have remained unchanged in every respect, and they were certainly, when fresh, the best I have ever seen. The algal pigments are, save in a few exceptional species, not at all altered.

The action of osmic acid does not seem to sufficiently harden the walls and cell-contents of the most delicate Florideæ (Callithamnion, Griffithsia, fringing hairs of Spyridias, Dasya, etc.) to prevent their shrinking even in very dilute glycerine, but no one of many other reagents experimented with gave much better results. Perhaps some of the workers at Wood's Holl, the present season, can remove the difficulty.

Most fungi suffer no change in dilute glycerine, although not previously hardened, and they may be well preserved in glycerine jelly. Such as are too delicate to do so otherwise may be enabled, in most cases, to withstand the distorting influence of glycerine by hardening in osmic acid, as described for the algæ. I have not yet succeeded, however, in satisfactorily preserving Saprolegniaceæ in this way, though the most delicate Mucoraceæ and Hyphomycetes do finely.

In short, it is not too much to say that the way is opened, by the process above described, toward the abandonment of fluids and cements and all the bothersome manipulation connected with their use, and the substitution of a technique simpler in detail and far more satisfactory in results.

Amherst, Mass.

On the nature of certain plant diseases.

ALEXANDER LIVINGSTON KEAN.

De Bary in his paper "On some Sclerotiniæ and sclerotium diseases,"[1] published in 1886, was the first to show that Sclerotinia (Peziza) sclerotiorum while apparently growing as a parasite actually grows as a saprophyte, but gives off in the process of its growth a ferment which swells the cell-walls and kills the tissue of the host, thus preparing the way for the fungus. In 1888 Marshall-Ward described a Botrytis growing upon a Lilium candidum which behaves in the same manner.[2] De Bary found that liquid obtained from vegetable tissue infested with Sclerotinia was capable of producing the characteristic decomposition of pieces of healthy tissue placed in it. Marshall-Ward not only obtained this same result, but also observed under the microscope drops of

[1] Bot. Zeit. 1886, nos. 22, 23.

[2] Annals of Botany, Nov., 1888. Vol. ii, no. vii.

a glairy fluid exuding from the tips of vigorous hyphæ, and I have studied this same Botrytis growing upon Lilium longiflorum and have observed the same phenomena.

Last autumn my attention was called to a rot of the sweet potato in which Rhizopus nigricans (Mucor stolonifer) was present; yet if spores of this fungus were sown upon a slice of healthy sweet potato they produced no effect, the spores not even germinating; while if a bit of the mycelium were placed in a similar position, rapid growth of the fungus and decomposition of the potato followed. If the slice had been previously killed by boiling, the spores germinated readily, producing the same results as the bit of mycelium. Rhizopus behaves in the same way in cultures made upon Irish potatoes, beets, turnips, carrots, apples, pears, and quinces. De Bary remarked this peculiarity in Sclerotinia, and thought that it was due to the fact that the fungus required to be nourished as a saprophyte in order to become facultative as a parasite. The habit of the Botrytis of the lily disease is slightly different. Its spores germinate readily in a drop of distilled water if the temperature be favorable,[3] but then they are large and contain considerable reserve material stored in them: while the conidia of the before-mentioned fungi are small and require external nourishment in order to be able to grow.

The following experiment illustrates this point, and also connects the Rhizopus definitely with the origin of the disease. A hanging drop culture of Rhizopus was made in a drop of sterilized orange juice, in which this fungus grows freely. When this culture was well under way the coverslip from which the drop depended was inverted and placed in the middle of a slice of healthy sweet potato. This was left over night, and in the morning it was found that the hyphæ were reaching over the edge of the coverslip and producing decay wherever they touched.

As De Bary found with Sclerotinia that the liquid squeezed from diseased portions of the host was poisonous to healthy tissue, so I have found with Rhizopus. The liquid was squeezed from a thoroughly rotten potato and filtered. Slices of healthy vegetable tissue immersed in this fluid were soon softened and decomposed. Other experiments were made, filtering the liquid through a porcelain filter, and (to entirely eliminate the chance of bacterial action) adding a drop of corrosive sublimate to each saucer of the liquid. The

[3] Kean, A Lily Disease in Bermuda. BOT. GAZETTE, Jan., 1890.

result was the same as that obtained in the previous experiments. Some efforts were made at obtaining the ferment in a pure state with a measure of success. Marshall-Ward found that alcohol coagulated the ferment. I found that on adding 20 cc. of 90 per cent. alcohol to 10 cc of the filtered liquid obtained as in the former experiments, a heavy gray flocculent precipitate was formed. This was filtered off and the filtrate was evaporated at a low temperature. Its residue was then redissolved in water. Pieces of vegetable tissue put into this liquid underwent no change, so that it was evident that the precipitate contained the effective substance. The precipitate is readily soluble in water, and the solution thus made acts in the same way on plant tissue as the original liquid. All attempts at obtaining the ferment in a purer state have failed. It is a neutral substance, its efficiency is destroyed by heat, and seen under the microscope it is amorphous, never so far as I have seen assuming a crystalline form. Not only was this precipitate obtained directly from diseased sweet potatoes, but pure cultures of Rhizopus were made in flasks with sterilized orange and lemon juice as a medium. After several weeks the culture medium was decanted off, filtered and treated with alcohol. A flocculent gray precipitate was immediately formed which was similar in appearance to that obtained directly from the sweet potato, and proved to have the same destructive properties.

I have been able to get a similar, if not identical, substance, not only from the lily Botrytis, but also from another Botrytis growing upon the common live-forever (Sedum telephium). Besides which I have found that if leaves of potato infested with Phytophthora infestans (Peronospora infestans) be crushed in a mortar with a little water, and the liquid poured off and treated with alcohol, a similar precipitate is formed having similar properties. In the cases of Rhizopus, the lily Botrytis, and the Botrytis on Sedum, I think I have been able to show conclusively that the facultative disease agent is a chemical one. Marshall-Ward has shown it to be true of the lily Botrytis, while De Bary before him showed it to be so in Sclerotinia. From analogy, having obtained a similar ferment from Phytophthora, I think it but natural to conclude that here again we have another case of this method of growth.

These fungi can not be called true parasites for their manner of growing is very distinctly saprophytic, the fer-

ment killing the tissue and thus preparing the way for the growth of the fungus.

De Bary was of the opinion that fungi living thus were in an intermediate stage between parasites and saprophytes, and were gradually changing their method of growth from one to the other. However this may be, it seems to me that as these fungi do not materially differ in other respects from numbers of other fungi, we may expect to find that this method of growth is far from uncommon.

It is a well established fact that one group of fungi, bacteria, grow in this way and thus produce the so-called germ diseases. Thus it would seem that these fungous diseases, if not fungous diseases in general, are essentially the same in nature as the bacterial diseases. The production of a chemical poison in these fungi may either be simply a product of their growth, or may be a special adaptation of these organisms for obtaining food. I should incline to the former view as the more probable one. On the chemical nature of this product, and its destructiveness to any associated organisms must depend the efficiency of the fungus as an agent of disease.

It has been my purpose in this article to indicate by a few examples taken as representatives, that what has been shown to be true of one group of fungi (bacteria) as disease agents, is true of numbers of others, and that the so-called "toxic theory" of disease is capable of extension to fungous diseases in general.

Ursino, Elizabeth, N. J.

Apical growth in roots of Marsilia quadrifolia and Equisetum arvense.

WM. M. ANDREWS.

In the study of apical growth in the roots of these plants, I have found some points differing from previous accounts and perhaps worthy of note. The following will embrace these points and also the methods and sectioning employed.

The principal points in regard to cell division in the apices of the roots of these plants have already been thoroughly discussed by Goebel[1] and De Bary[2], and will not be repeated here.

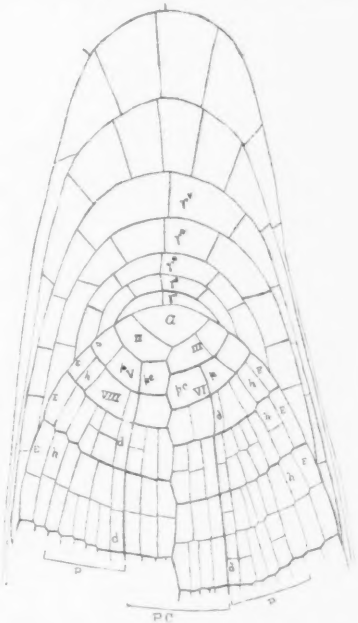


FIG. 1.

Fig. 1 represents the apex of the root of Marsilia in longitudinal section. Underneath the dermatogen is a single layer of hypodermal cells, which has a common initial cell with the dermatogen. This hypodermal layer (h, fig. 1), divides no more by tangential walls but remains a single layer.

Goebel[3] represents the transition from the bulky initial cells into the long narrow cells of the plerome cylinder, as taking place very abruptly, at about the 6th segment. The species figured was Marsilia sylvatrix. In the case of M. quadrifolia, I have noticed a marked difference. Here the transition is very gradual. From the time when the initial cells are cut off, the three tissues, dermatogen, periblem and plerome, are distinctly different.

The root-cap is formed from segments cut off from the base of the pyramidal apical cell. After every three segments cut off from the sides of this cell, there is one cut off from the base. This basal segment is, in the first place, divided into halves then quadrants, by walls which are nearly perpendicular to each other and to the outer surface of the segment. (See fig. 1.) Each of these cells is similarly divided, but there is much less regularity in the position of

[1] GOEBEL.—Outlines of Classification and Special Morphology of Plants. English Edition, 1887, pp. 265, 236-37.

[2] DE BARY.—Comparative Anatomy of the Phanerogams and Ferns. English Edition, 1884, pp. 17-20.

[3] GOEBEL.—l. c. p. 238.

the newer walls. The process of growth soon obliterates the regular arrangement of all but the first two walls.

There is no division of the root-cap segments parallel to the outer surface as figured by Goebel[4]. In Equisetum arvense there is no hypodermal layer as in Marsilia. The endodermis (d. fig. 2) divides into two layers at about the 5th or 6th segment[5]. These two layers are not further divided by tangential walls. The root-cap divides for a while, in the same way as in Marsilia. But now a new sort of division takes place. This is not noted in any of the authors to which I have access. A wall is formed, in part or all the cells of the root-cap, parallel to its outer surface (fig. 1, r^{II} and r^{III}). As growth continues and the cells of the root-cap diverge from the apical cell, their connection with each other becomes looser. They also lose their regular and somewhat radial position. From the first the root-cap is distinctly different from the dermatogen, and in a less degree the dermatogen, periblem and plerome are differentiated.

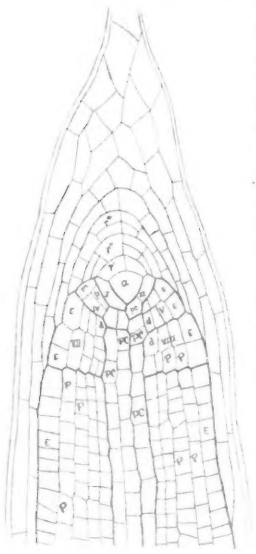


FIG. 2.

The paraffin imbedding process was used in making the sections. The stain used was alum cochineal for Equisetum, staining *in toto*. The roots of Equisetum were hardened in absolute alcohol, although chromic acid was also satisfactory. When hardened in chromic acid, the stain washes out and necessitates staining on the slide. The following is a formula of the methods employed:

	HOURS.
Harden in absolute alcohol or chromic acid	3–24
If in chromic acid, thoroughly wash.	
Stain in alum cochineal	3–24
Wash in distilled water five minutes.	
Dehydrate in 30%, 50%, 70%, 90% and absolute alcohol	3 each
Absolute alcohol, two parts, chloroform, one part	3 "
Absolute alcohol, one part, chloroform, two parts	3 "
Chloroform and paraffin (saturated solution)	3 "
Melted paraffin	3–12
Imbed.	

[4]See preceding note.
[5]Sachs, Text-book, p. 124, 2d English edition. De Bary, l. c., pp. 122, 351, 414.

The roots of Marsilia were hardened with chromic acid and stained on the slide with gentian violet. The methods employed with Equisetum gave good results in this case also. The sections were made with a Minot microtome and ran 1800 to the inch.

EXPLANATION OF FIGURES 1 AND 2.—Drawn with a Zeiss camera. Fig. 1, longitudinal section of root-tip of Marsilia quadrifolia ×300. Fig. 2, same of Equisetum arvense ×187. In both figures the reference letters are as follows: *a*, apical cell; II, III, V, VI, etc., segments of body of root; *P*, periblem; *p*, initial cells of periblem; *P C*, plerome cylinder; *p c*, initial cells of plerome cylinder; *E*, dermatogen; *h*, hypodermal layer; r^{i}, r^{ii}, r^{iii}, $r^{i,v}$ r^{v}, successive segments of root-cap; *d*, endodermis.

Botanical Laboratory, University of Indiana.

BRIEFER ARTICLES.

Origin of the honey-secreting organs.—A few sentences from Stadler's work "Zur Kenntniss der Nectarien"[1] seem to me to throw some light on the probable origin of the honey-secreting organs of flowers.

He says (I give free translations): "The vessels which are always present, if not in the tissue of the nectary itself, then in its substratum, are usually very strongly developed, terminating in the border of the gland tissue; indeed their more delicate elements, the cambiform, penetrate it."[2]

Also: "The nectaries not only satisfy the demand of insects for honey, but also account for the loss of water through evaporation, which is always considerable."[3]

And again: "In the vicinity of the nectary I found almost without exception some chlorophyll-bearing tissue. Even in regions where, because of other conditions, one would not expect it; as in Lilium auratum under the nectary between the two vascular strands; in the hood and in the anther-column of Asclepias Cornuti, etc. These chlorophyll tissues may by themselves alone, or together with others further away, be the laboratories for the manufacture of the carbo-hydrates which the nectaries need; they may, under no circumstances, give them to the nectary in a form directly capable of secretion."

The first of these statements is not surprising. In order to supply stamens and ovaries with the food materials so abundantly stored in pollen grains and ovules, there should be a strong current of water continu-

[1] "Beitrage zur Kenntniss der Nectarien und Biologie der Blüthen" von Dr. Stadler. Berlin, 1886.

[2] P. 69.

[3] P. 70.

ally bringing to them the crude materials from which starch, fats, proteids, etc., are made. Hence the necessity for a well developed vascular system in connection with the floral organs. For it is well known that water travels through wood vessels, and Haberlandt (among others) has shown[4] that there is a close parallel between the water conducting power of a tissue and the number of its vessels and tracheids.

But a current of water implies evaporation. Otherwise there could be no current, only stagnation. Moreover a large proportion of the water in which these dissolved substances are carried is not itself needed for growth (at least not after the flowers have expanded) or for food manufacture. It must be gotten rid of that more water containing needed working materials may take its place. The rapid withering of cut flowers is the logical result of this process and the proof of evaporation. Microscopic examination shows, too, that in addition to the commonly delicate character of the floral organs (and envelopes in many cases), this transpiration is often aided here, as from leaf surfaces, by the presence of stomata. Stadler finds the secretion of honey through stomata to be the "commonest case."[5] The fact, too, noticed by Müller and others, that honey is secreted only under certain conditions of temperature and sunlight, points to the conclusion that it is of the nature of, or stands in close relation to, evaporation.

It is a well known fact that some plants, which grow in soil containing much lime, have upon their leaves deposits of calcium which, carried in solution through the plant, have been left behind when the water was evaporated; *e. g.*, species of saxifrage.

Finally we have to notice the immediate connection with the nectary on the one hand, and with the vascular tissue on the other, of chlorophyll bearing cells, *i. e.*, of cells in which the crude materials brought by the water through the vessels may be united with carbon to form starch, with which, again, other organic compounds may be produced. These substances travel by osmosis from cell to cell until they reach the stomata, if there are any, or the subepidermal-layer of cells from which water is continually being drawn by vigorous surface evaporation. As the lime-laden water of saxifrage takes some of its burden to the very end of its course, leaving it only when the force of vaporization pulls them apart, so there seems nothing improbable in the supposition that water heavily (of course, only comparatively speaking) charged with sugar, the traveling form of starch, should carry some of that with it until it is itself vaporized, leaving it there as a saccharine deposit.

Stadler finds that in nearly one-half of the cases observed the glucose arises from the transformation of starch; in a few cases from fatty oils (Cydonia, Impatiens); in others from tannin, which is easily converted into starch, as starch is into tannin again (pages 71 and 72). All of these

[4] G. Haberlandt, Physiol-Anatomie, p. 213.

[5] Beitrage zur Kenntniss der Nectarien, p. 73.

substances are common in living cells, their transformation into the diffusible form of glucose is the phenomenon common to osmosis currents throughout the plant.

Perhaps here is a partial explanation of the presence in flowers of the materials upon which natural selection has worked in the production of honey: a large supply of water bringing to cells comparatively near the surface substances in solution which are there united into diffusible organic compounds, and rapid evaporation of this water which carries with it to the surface a small part of these materials dissolved in it. That the first secretions of this kind may not have been perceptibly sweet is suggested by the occurrence of nectar like that of Pinguicula, which is mere "slime," and by the fact that the nectar of different kinds of flowers varies greatly in degree, as in quality, of sweetness. The earliest nectaries were also probably unspecialized in form, mere surfaces from which evaporation went on from cells rich in pollen or seed-producing substance lying directly over a network of vascular tissue. Perhaps the watery secretion found the first day of blossoming, in the stigmatic cavity of Nymphæa tuberosa, represents such a primitive form. The development of greater sweetness, of peculiar form, of protective coverings (spurs, hairs, etc.), the localization of the secreting power in particular spots, etc., must be delegated to the working of natural selection—here, largely, insect selection—to which also the peculiar forms of the other parts of many flowers are generally admitted to be due.—ALICE CARTER, *Mt. Holyoke College, South Hadley, Mass.*

Peronospora Rubi Rabenh. **in America.**—Last year, after the GAZETTE's notice of the discovery of *Peronospora Cubensis* B. & C., here at New Brunswick, it was found in at least two other localities in the United States. A similar note to the effect that on May 26th the *Peronospora Rubi* Rabenh. was discovered upon Rubus strigosus may lead observers to look for this species elsewhere. I do not find any record of this mildew having previously been seen upon living hosts in this country. As it was taken upon cultivated raspberries it becomes of interest to growers of this fruit, as it is very likely it will spread to other cultivated species of the genus, for its two hosts in Germany are R. cæsius and R. fruticosus.—BYRON D. HALSTED, *New Brunswick, N. J.*

Cynosurus cristatus L.—I have noticed, lately, the "crested dog's-tail grass" (Cynosurus cristatus) growing abundantly in the small grass plots, in Boston, before many of the houses. It also occurs in Cambridge in similar situations. I inquired at one of the large seed stores in Boston, and was informed that it was mixed with other grass seeds and sold for use on lawns and the like. The species is a native of Europe and Northern Africa, and as its roots sink deep into the ground it can withstand droughts much better than many other grasses.—WALTER DEANE, *Cambridge, Mass.*

EDITORIAL.

WE OBSERVE with pleasure the undertaking of the Commissioner of Education to collect and publish statistics and extended information regarding the teaching of biology in the colleges and universities of the United States. We have reached a time when we may well take a survey of what has been accomplished as an incentive to the furthering of work in this line. The forthcoming report will show a very rapid extension of laboratory work in the past years, and it will bring to notice some of the inequalities in the distribution of biological instruction, which it will be well for the colleges interested to correct. It will show, for example, that one of the foremost of our universities has two unusually able men teaching zoology, and practically no botanical instruction. It will show that another with a wide reputation has the same weakness. It will show that the instruction in botany in many of the colleges is yet of the high school grade, recognizing the existence of no plants but the Phanerogams. It will show that some of our oldest institutions have been the slowest to recognize the necessity of adopting the laboratory method of instruction. In many other directions we think that this report will prove both instructive and suggestive to biologists and college presidents.

STRANGE as it may seem, many of the alterations in college courses are due not so much to the conviction of the faculty that the change is a desirable one *per se*, as to the conviction that it is necessary in order to compete successfully with other institutions. Some leaders there must be in every reform, and many followers. Statistics in regard to botanical instruction at the present time will prove to even the most conservative college president or faculty that it is imperatively necessary to recognize the science of botany in the curriculum as of equal importance with chemistry and physics, if a college is to offer any choice of work to its students, or if it is to compete on equal terms with others on which it perchance looks down. Speed the day when we shall see *thorough instruction* in the science whose interests the GAZETTE strives to promote. Speed the day when we shall see *general instruction* in the science whose interests the GAZETTE strives to promote. Speed the day when we shall see *opportunity for research* in the hands of the teachers and richer *endowment of research* in the science whose interests the GAZETTE strives to promote.

CURRENT LITERATURE.

Australian plants.

BARON MUELLER has just issued the first part of his second systematic census of Australian plants, containing Phanerogams and Pteridophytes. It is a volume of nearly 250 large pages, and in addition to being

a catalogue it contains chronological, literary, and geographical annotations. It is a work of vast labor, presenting in compact shape the known flora of a continent, its distribution, its relation to other continents, and a key to its literature. It enumerates 156 families, 1,409 genera, and 8,839 species. Of this number 7,501 are endemic in continental Australia and Tasmania, a tremendous proof of long isolation. Only about 15 per cent., therefore, extend to other countries. Of these 1,338 species in common with the rest of the world 160 are found in Europe, 1,032 in Asia, 515 in Africa, 315 in America, 558 in Polynesia, and 291 in New Zealand. Immigrated plants are entirely excluded from the enumeration. The 10 predominant orders are as follows: Leguminosæ (1,065 species), Myrtaceæ (663), Proteaceæ (597), Compositæ (539), Cyperaceæ (380), Gramineæ (345), Epacrideæ (275), Orchideæ (271), Euphorbiaceæ (224), Goodeniaceæ (220). The Filices follow close after with 212 species. Families prominent with us, but poorly represented in Australia, are as follows: Cornaceæ (1 species), Hypericaceæ (2), Hydrophyllaceæ (2), Caprifoliaceæ (2), Cupuliferæ (4), Onagraceæ (5), Primulaceæ (6), Ericaceæ (6). Of our great families Rosaceæ and Ranunculaceæ there are but 17 species each. Altogether it is a most interesting and compact showing of Australian botany.

Contributions from the National Herbarium.

It is a matter worthy of prominent mention that the National Herbarium has begun the publication of a series of botanical contributions These contributions are the natural outcome of the vast amount of material brought together under the direction of Dr. George Vasey. American botanists are greatly indebted to Dr. Vasey for the development of such an herbarium, and now still more so that he has organized a series of publications that will present to botanists information concerning the new and interesting plants of our domain. We give this enterprise our warmest commendation, and would express the hope that it will include not only the publication of interesting collections, but also monographs of plant groups. The first number has just appeared (dated June 13, 1890), and is devoted chiefly to the collections made in 1889, in lower California, by Dr. Edward Palmer, one of our very best collectors. A list of 224 species is first given, being plants collected by Dr. Palmer, in 1888, in southern California. The collections of 1889, in lower California, are published under five heads, as follows: Lagoon Head (50 species, three of which are new); Cedros Island (97 species, including four new ones); San Benito Island (17 species); Guadalupe Island (63 species, four of which are new); Head of the Gulf of California (18 species).

In many cases critical notes accompany the species. The work seems to have been committed chiefly to Mr. Rose (to whom are credited all the new species excepting one by Dr. Millspaugh), under the supervision of Dr. Vasey, and assisted by Mr. F. V. Coville in his special groups. The botanists of the National Herbarium are to be congratulated upon the fine showing they have made in the initial number of their new departure.

Diseases of plants.

The general interest in the subject of the specific diseases of plants and of their treatment has grown much faster than has a corresponding literature. The Germans have a few good general treatises on plant pathology, both technical and non-technical, but in English the publication of such works has barely begun. Smith's "Diseases of Field Crops," which appeared some time ago, is in many respects excellent, but contains paragraphs and almost whole chapters of controversial matters neither interesting nor edifying to the general reader. This was the first general work on plant diseases in the English language; the second one[1] has just appeared. It reminds one of its predecessors in the make-up of the volume, but not at all in the manner of treating the subject. The author, Professor Ward, is known to American botanists not only by his able investigations, but also by the admirable diction of his scientific articles. The present work is in a line with his other writings, and is to be commended for the careful arrangement of the subject and its clear and trustworthy treatment. It is intended as an introduction to the subject for non-technical readers. The book opens with a happy discussion of the meaning of disease in plants, and then proceeds to the consideration of a few common diseases, such as "damping off" of seedlings, club root of cabbage, potato rot, wheat and oat smut, ergot of rye, bladder-plums hop mildew and wheat rust. The very simple and accurate treatment of these topics should make the book a popular one with the class of readers it is designed to reach.

Minor Notices.

By the American student of lichens, at least, the issuing of a synopsis of the difficult genus Arthonia by Mr. Henry Willey will be gladly received. He enumerates 348 species, a half dozen or more of which are new ones. He also excludes more than 30 species which have been wrongly referred to the genus. There are quite a number of Cuban specimens which he proposes as new but does not name. The reason assigned is the fragmentary material, and that Dr. Müller has had the same collections and has possibly named them already. Mr. Willey has dealt with the synonomy as fully as could be done without studying the herbaria of Europe. His arrangement of species is an artificial one, but with the key it will afford great assistance in determining the species. The synopsis can be obtained from the author, at New Bedford, Mass., for $1.50.

Mr. W. C. Sturgis has carefully studied a number of lichens most closely allied to the Collemaceæ with a view to determining whether at any time two separate systems of hyphæ exist in the fruit, the one giving rise to the asci and the other to the paraphyses, and whether any form of

[1] Ward, H. Marshall. Diseases of Plants, p. 196. 53 illust., 12mo. London: Soc. for Prom. Christian Knowledge. [1889.] 2s. 6d.

sexual reproduction could be found. Having found the asci and paraphyses in all cases arising together, and discovering no trace of sexual reproduction, he was led to re-examine some of the Collemaceæ with a view to establishing or disproving Stahl's well-known conclusions. His investigations were entirely confirmatory of Stahl's. It appears, therefore, that we have among the homœomeric lichens two types of sexual reproduction, while among the heteromeric species the reproduction is purely vegetative, as it is in some ascomycetous fungi. [2]

THE PAPER by Mr. Setchell on the structure and development of Tuomeya fluviatilis[3] very aptly supplements the recent monograph of Professor Atkinson on the Lemaneaceæ since the very thorough examination to which the author has subjected it shows clearly how closely it unites Lemanea and Batrachospermum.

THE EARLY stages in the germination of the macrospore of Isoetes echinospora show a remarkable similarity to the formation of the endosperm in the conifers, since the nucleus divides into a large number of daughter nuclei before any cell walls are apparent. Such is the substance of a brief article by Professor Douglas H. Campbell in the Berichte der Deutschen bot. Gesells. viii. pp. 97–100, pl. 1.

Mr. F. H. KNOWLTON has just issued a revision of the genus Araucarioxylon of Kraus. The discussion involves the presentation of three genera, Cordaites (11 sp.), Dadoxylon (26 sp.), and Araucarioxylon (13 sp.)

DR. GEORGE WALTER has carefully examined the brown sclerotic elements among the parenchymatous tissues of the rhizomes of a large number of ferns. Particular attention was given to the isolated groups and strands of cells designated by Russow as "Stützbündel." Dr. Walter has studied the development of the cell-groups, the thickening of the walls and the character of the coloring material which gives them their dark brown or almost black color. These coloring matters are phlobaphens, and begin to be deposited as the tissues have lost their power of division. The extraordinary hardness of this tissue is also due to these substances, which are either chemically united with the cellulose or infiltrated. The many interesting details must be sought in the memoir itself, which appears as one of the parts of the Bibliotheca Botanica.[4]

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[2] STURGIS, WILLIAM C.—On the carpologic structure and development of the Collemaceæ and allied groups. Contrib. from the Crypt. Lab. of Harvard University, XI. Reprinted from the Proc. Amer. Acad. of Arts and Sci. Vol. xxv, pp. 15–52, pl. 8. 8vo. May, 1890.

[3] SETCHELL, WILLIAM ALBERT.—Concerning the structure and development of Tuomeya fluviatilis, Harvey. Contrib. from the Crypt. Lab. of Harvard University, XII. Reprinted from Proc. Am. Acad. Arts and Sci. pp. 53–68. 1 double plate. May, 1890.

[4] WALTER, DR. GEORGE.—Ueber die braunwandigen, sklerotischen Gewebeelemente der Farne, mit besonderer Berücksichtigung der sog. "Stützbündel" Russow's. Bibl. bot. heft 18. pp. 21. pl. 3. 4to. Cassell: Theodor Fischer. M. 6.

OPEN LETTERS.

Tissa vs. Buda.

As you have considered it worth while to reprint what the learned editor of the *Journal of Botany* has to say on this subject, and as he has declined to publish a note sent him by me on the same matter, apparently because afraid of the argument therein contained, I venture to request that you give me space enough to say that my decision to take up *Tissa* rather than *Buda* was reached simply from the fact that *Tissa* stands first on the page in Adanson's "Familles des Plantes." This priority of place is certainly nearly as important to enforce as priority in time of publication; it is always easily determined, and has to be considered frequently, there being numerous cases of the duplication of species or genera by authors in the same book, and often, indeed on the same page. There must be some decision reached in such cases, and I think it will generally be admitted that the name standing first should be used. I mentioned this in my paper on *Tissa* (*Bull. Torr. Club*, xv. 125), as also the acceptance of *Buda* by Dumortier.

The editor of the *Journal* uses a weak argument, when he says that from the fact of *Buda* having once been taken up, this course should be followed. On that basis where would the law of priority come in, for which he used to contend so vigorously? If he can not find a more vulnerable spot than this for criticising what he is pleased to call "the eccentricities of the neo-American school of nomenclature" he had better refrain still longer from comment. He has been refraining for so long that we began to think him converted to a rational system of nomenclature.

Tissa was first taken up at very nearly the same time by M. Baillon and Professor Greene, independently. It is accepted in Engler and Prantl's new work, so it may be remarked that the "neo American school" is not quite alone in this "eccentricity."

N. L. Britton.
Columbia College, New York City.

NOTES AND NEWS.

An introduction to systematic botany by Professor C. E. Bessey will shortly be published by Henry Holt & Co.

Dr. A. N. Berlese, assistant at the Botanic Garden of Padova, Italy, has been made professor of botany at the Lycée Royal de Ascoli-Piceno.

The Botanical Club at the Indianapolis meeting will have Dr. N. L. Britton, as presiding officer, and Professor Charles R. Barnes, as secretary.

Professor Ed. Prilleux has recently received a prize of 4,000 francs from the French Academy of Sciences for a study of the diseases of cereals.

The library of the late Rev. M. J. Berkeley will be sold by John Wheldon 58, Great Queen street, London, E. C. A catalogue has been issued.

AN INTERNATIONAL EXHIBITION of botany will be held during the present year in Belgium, and also in connection with it an exhibition of microscopy.

THE COLLEGE of Montana has conferred the degree of "Doctor of Science" upon two well known Montana botanists, Rev. F. D. Kelsey and Mr. F. V. Anderson.

DR. ALEX. TSCHIRCH, heretofore Privat-Docent in the University of Berlin, has been called to the Professorship of Pharmacy and Pharmacognosy at the University of Berne.

AN OUTING for scientific exploration and pastime is being arranged for July and August by Rev. F. H. Wales, of Tulare City, Cal., to visit Mount Whitney and vicinity in California.

BOTANISTS may be glad to know that good photographs, cabinet size, of the late Dr. C. C. Parry may be obtained of Jarvis White & Co., photographers, Davenport, Iowa, for 25 cents each.

COOKE'S ILLUSTRATIONS of British Fungi will be brought to a close with volume eight, which is to be issued during the present year. The complete work will be about $160, bound in cloth.

MANY BOTANISTS from whom papers are expected at the Association meetings come without any preparation, to the great disappointment of those who expect that all whose names are familiar in the science will take some part.

M. H. DOULIOT, in *Journal de Botanique* (June 1), has an interesting illustrated paper on the development of coniferous stems. The species considered and figured are Picea excelsa, Torreya nucifera, Cryptomeria elegans, and Sequoia sempervirens.

MR. M. C. COOKE is preparing an introduction to fresh-water Algæ, to be published by Kegan Paul, Trench, Trübner & Co, with descriptions of British genera and species, and figures of the genera. It will form a volume of the International Scientific Library.

MR. J. G. BAKER, has been appointed curator of the herbarium and library at Kew, in place of Professor Oliver, whose resignation has already been referred to. Mr. Baker has been first assistant for twenty-four years, and this promotion is surely a most worthy one.

IN *American Garden* (July), Professor L. H. Bailey writes of the "false shag-bark hickory" (*Hicoria microcarpa*, Britton), showing it to be clearly a distinct species, and not at all to be confused with the true shag-bark (*Hicoria ovata*, formerly *Carya alba*), as some have thought.

ERRATUM.—In Mr. E. J. Hill's paper in the last number of the GAZETTE, there occurs a mistake on page 141, line 5 from top, which may make a wrong impression. The word "port" should read "part," as designating one of the two localities where the collections were made in Northern Michigan.

A STATUE of Linnæus will shortly be placed in Lincoln Park, Chicago, work on the foundation having already begun as we learn from the *American Florist*. The statue is now on its way from Sweden, where it was cast. It is the gift of the Swedish residents of Chicago, while the pedestal with its allegorical figures is provided by the park commissioners.

THE Division of Botany of the Department Agriculture has obtained an appropriation of $40,000 for the prosecution of botanical work during the coming year. This does not include salaries.

IT IS to be hoped that there will be no lack of botanical papers at the Indianapolis meeting. Every working botanist must have done something during the past year, and if he does not care to make a formal presentation of it before Section F., the informality of the Botanical Club will answer his purpose.

DR. LORENZO YATES, of Santa Barbara, Calif., has published a list of the known flora of the Channel Islands off the coast of Southern California, showing the collections made by Professors Greene, Brandegee, Ford and Yates. The list will be found in the Ninth Annual Report of the State Mineralogist of California.

MR. JOHN DONNELL SMITH has returned from Guatemala with another large collection of plants. Certain families are distributed among specialists in this country and Europe, for the purpose of expediting the work. Mr. Smith is to be commended for his zeal in bringing to light the botanical treasures of a very rich field.

DR. H. KLEBAHN, in a review in the *Centralblatt für Bakteriologie* und *Parasitenkunde* (vii, p. 382) of Mr. Bolley's article on epidermal rusts, published in this journal for June of last year, concurs in the view that the so-called paraphyses of Puccinia rubigo-vera and allied species are not true paraphyses but a special form of the hyphæ.

A SERIES of colored wall charts to illustrate some of the facts of plant physiology has been begun. They are prepared by Drs. Frank and Tschirch, and published by Paul Parey of Berlin. Each chart is 69 by 85 cm., and the first set of ten, now ready, sells for 30 marks ($7.50). They are intended to do for physiological botany what Kny's wall charts, which they much resemble, do for structural botany.

IN THE KEW BULLETIN for June there is a list of the timber trees of Straits Settlements, containing 150 species. To one familiar only with American trees the family relationships of this antipodal timber seem strange enough. The families containing more than five species are as follows: Myrtaceæ 15, Euphorbiaceæ 13, Leguminosæ 11, Rubiaceæ 9, Sterculiaceæ and Urticaceæ each 8, and Burseraceæ 6.

IT HAS BEEN suggested by Dr. Beyerinck, according to the *Botanische Zeitung* (xlviii, 202), that as micro-organisms obtain no nourishment from gelatine or agar-agar, their culture on such solid media may be used to determine whether any particular soluble substance my be used by the organism under trial. The substance to be tested is placed in drops on a plate culture. If it is a nourishing substance the organism will flourish in a circle about the drop. If a poison is used a deadly influence will be noticed.

IN AN inaugural dissertation at Marburg, C. Giesenhagen discussed the growth of the cystoliths of Ficus elastica. The stalk of the cystolith consists, he says, of similiar cap-like superposed membrane lamellæ. The body is constructed in like manner, except that carbonate of calcium is laid down in and between the layers. On account of this infiltration of lime the layers of the body increase in size after they are first formed. The radiating strands in the body reaching out to the points on the surface are canals filled with $CaCO_3$.

DR. A. N. BERLESE, assistant in the preparation of Saccardo's Sylloge Fungorum, proposes to issue a series of colored illustrations to accompany that work. Four parts will be published annually at 20 francs each. It will open with the Pyrenomycetes. Subscriptions may be sent to the author, whose address is Lycée Royal à Ascoli-Piceno, Italy.

AT A recent meeting of the botanical society of Munich, Dr. R. Hartig spoke of the high absorptive power of snow in respect to sulphuric and sulphurous acids, and called attention to the injury done to the conifers in newly built portions of the city by the smoke. In 16 days' exposure the amount of SO_3 in the snow increased from 7 mg. per kilo to 91.5 mg., while in nearly the same time, snow 7.5 km. west of the city absorbed less than 8 mg. per kilo. Conifers which up to three years ago had been vigorous have been destroyed, he believes, by the coal smoke coming from the residences.

THE SECTION of Vegetable Pathology of the Department of Agriculture, by a recent act of Congress, has been made a Division, so that now it is on an equal footing with the other branches of the Department. The work is now thoroughly organized with a good corps of assistants in the laboratory and field. One of Mr. Galloway's assistants is now in Europe investigating a grape vine disease there, in the hopes of getting some light on the Californian grape trouble. This Californian disease is thought to be identical with one now prevailing in Italy, Spain, and Northern Africa, and the assistant, Mr. Pierce, will visit these countries for the purpose of definitely settling the matter.

MR. ALFRED FRYER, in *Journal of Botany* (June), describes supposed hybridity in Potamogeton. His conclusions are more far reaching than a mere case of hybridity, and are as follows: (1) That nearly allied forms of Potamogeton certainly cross; (2) that these cross-bred plants are sometimes fertile; (3) that their offspring varies from seed just as artificially produced hybrids do: (4) that Potamogetons may progress from absolute sterility to more or less complete fertility, under the influence of extended time and favorable conditions. In conclusion, the author says that, if he is correct, we may safely assume that crossing of "species" has been, and still is, one of the methods by which other species are fashioned.

ARRANGEMENTS for the Indianapolis meeting are being completed in a way that will insure a very enjoyable meeting of the American Association. The Denison House has been chosen as hotel headquarters and the new and magnificent State House will admit all the sectional meetings under one roof. On Wednesday, August 20th, the first general session of the meeting will begin at 10 A. M., in the House of Representatives. The Botanical Club will hold a meeting on Thursday, August 21, in the rooms of Section F, and special arrangements are being made for their entertainment. It is expected that a larger number of botanists will be in attendance than ever before. While nothing unusual in the way of collecting can be offered, interesting ground in this great Central West will be visited, and an enjoyable time may be expected. Botanists should not only be present in large numbers, but should come prepared with papers, either for Section F, or for the Club meetings, or for both. Communications with reference to the Club should be sent to the President, Dr. N. L. Britton, Columbia College, New York, or to the Secretary, Professor Charles R. Barnes, University of Wisconsin, Madison, Wis. All botanists intending to be present will please notify Professor John M. Coulter, Crawfordsville, Indiana.

J. BLASS objects to the usually accepted notion that the sieve portion of the fibro vascular bundle has for its special function the conduction of the nitrogenous materials, on the grounds that the sieve tubes are wanting at the place where there is the most need of nitrogenous materials, viz., the growing points; and that the conductivity of the tubes is not sufficient on account of the small size of the pores, the autumnal closing with callus, and the comparatively small number of the tubes. From his researches he comes to the conclusion that no distributive conduction of nitrogenous materials takes place through the sieve tubes, but that their function is to temporarily store nourishment for the cambium and the production of wood, just as the starch sheath does for the bast.

IN THE LAST *Pittonia* (Vol. ii, pt. 8), there are several interesting papers. Professor Greene has a paper on some N. Am. Ranunculi, in which he describes R. rugulosus (Calif.) as new, and replaces *R. ambigens* Watson by *R. obtusiusculus* Raf., *R. rhomboideus* Goldie by *R. ovalis* Raf., and *R. multifidus* Bigelow by *R. lacustris* Beck & Tracy. The same author proposes the generic name *Sidanea* for the *Schizonotus purpurascens* of the Synopt. Fl., on the ground that the generic name Schizonotus is preoccupied. Mr. J. G. Lemmon describes 3 new Californian plants, one of which is an Arcto-taphylos. "New and noteworthy species," by Professor Greene, contains, among other things, 4 new species of Calochortus, a number of new Dodecatheons, a discussion of Troximon with a description of several new species, and 4 new species of Downingia.

THE WILL of the late Henry Shaw contains this clause: "I hereby bequeath $1,000 annually for a banquet to the trustees of the garden, and to the guests that they may invite, literary and scientific men, and friends and patrons of the natural sciences." The first of these banquets was given at the South-rn Hotel in St. Louis on the evening of May 26th. Covers were laid for 100 guests, and many distinguished scholars of the city and elsewhere discussed an elaborate *menu*. The most distant guests were President Adkins of Corvallis, Oregon, and Dr. W. G. Farlow of Cambridge. Among the toasts we note one to Henry Shaw, responded to by the President of the Board of Directors of Washington University, Col. George F. Leighton; the future of the Missouri Botanical Garden, responded to by the Director, Dr. Wm. Trelease; and the State of Missouri, responded to by the Governor, David R. Francis. The first banquet was a grand success.

THE IOWA ACADEMY OF SCIENCES has issued its Proceedings for 1887–9 in a neat octavo of 101 pages. It embraces only original work, and makes a creditable showing. The botanical papers are seven in number: two by R. E. Call on "Some ferns of the Ozark region of Missouri" and "Notes on native forest trees of eastern Arkansas;" three by L. H. Pammel on "Beggiatoa alba and the dying of fish in Iowa," "Some fungous diseases of fruit trees in Iowa" and "A cherry disease;" a list of twenty "Ferns of Muscatine county, Iowa," by F. M. Witter; and "Notes on a fossil wood from the Keokuk limestone" by C. H. Gordon. It is curious to note that there is no mention of the previous existence of a society with the same name, partly the same membership and a similar constitution, except an incidental reference in the president's 1888 address. The earlier society under the leadership of Professor C. E. Bessey did good work, had an existence of ten years, and had become inactive but two years before the new society was formed. Its only published record of proceedings was printed in 1880.